



DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

[Docket No. NHTSA-2018-0058]

Denial of Motor Vehicle Defect Petition

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

ACTION: Denial of a petition for a hearing on remedy of defect.

SUMMARY: This notice sets forth the National Highway Traffic Safety Administrations (NHTSA) decision and reasons for denying a petition, (DP15-001) submitted to NHTSA requesting that the agency conduct a hearing to examine the remedy for Ford recall 14S05 (NHTSA recall 14V-284) and to require Ford to provide an adequate remedy.

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SUPPLEMENTARY INFORMATION:

Introduction

After a vehicle or an item of motor vehicle equipment has been determined to contain a defect that relates to motor vehicle safety, any interested person may petition the National Highway Traffic Safety Administration (NHTSA) requesting that the agency hold a hearing to determine if a manufacturer has met the defect notification and remediation requirements imposed by the National Traffic and Motor Vehicle Safety Act (“the Safety Act”), 49 U.S.C. Chapter 301. 49 U.S.C. § 30120(a)(2), 49 CFR § 557. Upon receipt of a properly filed petition,

the agency conducts a review of the petition, any material submitted with the petition, and any additional relevant information. *See* 49 U.S.C. § 30120(c); 49 CFR § 557.4. The review may consist solely of a review of information already in the possession of the agency, or it may include the collection of information from the motor vehicle manufacturer and/or other sources. After considering the available information and taking into account appropriate factors, including the nature of the complaint, seriousness of the alleged breach of the manufacturer's obligation to remedy, existence of similar complaints, ability of NHTSA to resolve the problem without a hearing, and assessing whether the remedy provided resolves the safety risk presented by the defect, the agency will grant or deny the petition for a hearing. *See* 49 U.S.C. § 30120(e); 49 CFR § 557.6.

Petition Background Information

In a submission dated February 3, 2015, Ms. Abigail Dayton (the Petitioner) filed a petition (DP15-001) requesting that NHTSA conduct a hearing to examine the remedy for Ford recall 14S05 (NHTSA Recall No. 14V-284) and require Ford to provide an adequate remedy. The Petitioner alleges that, after a dealer performed the recall remedy on her vehicle by performing a software update, she experienced a failure in the Ford Electric Power Assisted Steering (EPAS) system that required replacement of the steering column at her own expense. She further alleges that the EPAS failure necessitating the replacement of her steering column was "the precise issue for which Ford issued recall 14S05 in the first place." The petition also presented accounts of similar post-remedy failures reported by other consumers on "various forums and websites."

NHTSA has reviewed the material cited by the Petitioner. The results of this review and our evaluation of the petition are set forth in the DP15-001 Petition Analysis Report, published in its entirety below.

The facts Petitioner alleges are cause for concern regarding the approach adopted by Ford and are a source of significant frustration for Petitioner and others similarly situated who simply want their vehicle to run the way it was designed to, particularly after being repaired by the vehicle manufacturer. However, in light of NHTSA's statutory authority, after thorough assessment of the material submitted by the Petitioner and the factors NHTSA is required to consider in determining the proper resolution of a petition for a hearing on whether a manufacturer has reasonably met its obligation to remedy, NHTSA has decided not to grant the petition to hold a hearing. Accordingly, and for the reasons more fully explained in the below Petition Analysis Report for DP15-001, the petition is denied.

Petition Analysis Report - DP15-001

1.0 Introduction

In a letter dated May 27, 2014, Ford Motor Company (Ford) submitted a Defect Information Report (DIR) to the National Highway Traffic Safety Administration (NHTSA) describing an Electric Power Assisted Steering (EPAS) system defect in certain model year 2008 through 2011 Ford Escape and Mercury Mariner vehicles (NHTSA Recall 14V-284, Ford 14S05) (the recall).¹ The DIR described a defect in the EPAS torque sensor that could result in a loss of power steering assist while driving. The DIR did not identify any other defects in the EPAS system.

¹ Documents related to the recall are available at www.nhtsa.gov under recall ID number 14V-284 (<https://www.nhtsa.gov/recalls>).

Ford's remedy involved updating the system's software to mitigate the occurrence of loss of power steering assist while driving due to the torque sensor defect. Vehicles diagnosed with a torque sensor fault code at the time of the recall repair would have the torque sensor replaced, while vehicles diagnosed with fault codes related to other EPAS components would have the steering column replaced.² Ford has not initiated any separate field actions to extend the warranty coverage for repairs of torque sensor failures, or any other EPAS component faults, occurring after the recall repairs were completed.³

In a petition dated February 3, 2015, and received by NHTSA on February 5, 2015, (DP15-001) Ms. Abigail Dayton (the Petitioner) requested that the agency conduct a hearing to examine the remedy for the recall and require Ford to provide an adequate remedy. On November 1, 2014, a dealer performed the recall remedy on the Petitioner's 2008 Ford Escape vehicle by performing the software update. On January 5, 2015, 65 days after the recall remedy was completed on her vehicle, the Petitioner's vehicle experienced a failure in the EPAS system requiring her to pay for replacement of the steering column. Replacement of the steering column was an alternative remedy in the recall depending on what fault codes were present at the time the repair was made by a Ford dealer. The Petitioner alleged that the post-remedy steering column EPAS failure was "the precise issue for which Ford issued recall 14S05 in the first place." The Petitioner also alleged that a pattern of similar post-remedy failures reported by other consumers on "various forums and websites", along with several additional allegations,

² Replacement of the torque sensor with the redesigned service part or the steering column assembly, which includes the torque sensor, would serve the dual purpose of repairing the diagnosed fault condition and removing the defect identified in Ford's DIR.

³ Warranty extension programs, also known as special policy adjustments, are field actions that are separate and distinct from safety recalls. Safety recalls require the manufacturer to identify the defect, develop a remedy, and apply the remedy to all of the affected vehicles to prevent a specific safety hazard from occurring. Warranty extensions adjust the vehicle age and mileage for which the manufacturer will cover the cost of repairing specific components after they have failed or display certain symptoms.

support her request that the agency hold a hearing and order Ford to provide a different remedy for the defect.

1.1 Petition allegations

The Petitioner claims that the recall remedy conducted on her vehicle did not resolve the safety defect. Further, the Petitioner explains that she received a recall notice in July 2014 for NHTSA Recall No. 14V-284 and she obtained a repair from an authorized dealer in November 2014. However, Petitioner asserts that the remedy, in fact, did not repair the vehicle, as evidenced by the fact that the power steering assist failed “soon thereafter.” When Petitioner returned to the dealership in January 2015, the vehicle returned fault code B2277, which would authorize her for a different remedy under the recall had her vehicle not previously been repaired in November 2014. Petitioner goes on to surmise based on the alternative remedies available based on different fault codes, and the way that fault codes are pulled from the vehicles, that:

Ford either knew the PSCM⁴ would fail intermittently and would not always provide a fault codes (*sic*), knowing that requiring the dealership to pull a specific ‘fault code’ before replacing affected components may potentially not repair the defect or, alternatively, Ford’s software update caused or accelerated issues with affected vehicles’ PSCMs requiring eventual replacement of the affected components.

Pet. at 9.⁵ Petitioner also notes that her own “investigation quickly revealed” at least 20 other individuals reported the same issue on various websites and online forums. Pet. at 4. Ultimately, through a series of related statements the Petitioner alleges that “the software update does not mitigate the risk associated with the recall,” “the software update did not . . . ‘repair’ the defect associated with Recall 14S05” and Ford’s “[f]ailure to repair the affected vehicles which

⁴ Power Steering Control Module (PSCM).

⁵ Excerpt from page 9 of the petition.

experienced PCSM (*sic*) loss and/or torque sensor issues after receiving the software update does not address the concern and underlying reason for the recall: to prevent affected vehicles for (*sic*) safety related failures and resulting accidents and injuries.” Pet. at 8.

2.0 Background

2.1 Legal Background

The Safety Act requires vehicle manufacturers to remedy safety-related defects in their vehicles by repairing the vehicle; replacing the vehicle with an identical or reasonably equivalent vehicle; or refunding the purchase price, less a reasonable allowance for depreciation. 49 U.S.C. § 30120(a). The statute allows a manufacturer to choose its own remedy and NHTSA does not approve manufacturers’ remedies. *See id.* If a manufacturer elects to repair a safety-related defect, the repair must be done adequately within a reasonable time. 49 U.S.C. § 30120(c). If the repair is not done adequately within a reasonable time, the manufacturer must replace the vehicle with an identical or reasonably equivalent vehicle, or refund the purchase price, less a reasonable allowance for depreciation. *Id.*

2.2 Sequence of events in NHTSA Recall No. 14V-284

As noted above, Ford initiated the recall by filing the DIR on May 27, 2014. The DIR described the defect as “a poor signal to noise ratio in the torque sensor within the Electric Power Steering (EPS) that does not allow the PCSM to determine the driver’s steering input.” As noted above, the safety consequence was stated to be loss of power assist while driving. The DIR described the remedy as follows:

Dealers will update the Power Steering Control Module (PCSM) and instrument cluster module software. The updated PCSM software changes the torque sensor fault strategy and will no

longer remove power steering assist during an ignition cycle for a single torque sensor fault. Additionally, the software update will provide audible and visual warnings to the driver in the unlikely event that a torque sensor fault is detected.

Two days later, on May 29, 2014, Ford issued a bulletin to Ford dealers advising them of the recall. This bulletin described the defect as a fault in the torque sensor and stated that a complete Dealer Bulletin relating to the issue would be provided when software to perform the repair became available.

On May 30, 2014, Jennifer Timian, Chief of NHTSA's Recall Management Division, responded to the Ford DIR in an acknowledgement letter confirming receipt of the defect notice.

Among other things, the letter described the remedy for the defect as follows:

Ford will notify owners, and dealers will update the software for the power steering control module and the instrument cluster module, free of charge. The recall is expected to begin by July 25, 2014. Owners may contact Ford customer service at 1-800-392-3673. Ford's number for this recall is 14S05.

Ford filed an amended DIR on June 2, 2014. According to Ford's cover letter, this amended DIR provided additional detail pertaining to the remedy program. Thus, while Ford's description of the defect (encompassing only the torque sensor) remained unchanged, the amended remedy description stated:

Dealers will check the Power Steering Control Module (PSCM) for Diagnostic Trouble Codes (DTC):

- If no loss of steering assist DTCs are present, dealers will update the PSCM and instrument cluster module software. The updated PSCM software changes the torque sensor fault strategy and will no longer remove power steering assist during an ignition cycle for a single torque sensor fault. Additionally, the software update will provide audible and visual warnings to the driver in the unlikely event that a torque sensor fault is detected.

- If upon initial inspection certain loss of steering assist DTCs are present, the dealer will either replace the torque sensor or the PSCM, depending on the DTC present.⁶

NHTSA acknowledged receipt of the June 2, 2014 amended DIR by a letter dated June 4, 2014. This June 4, 2014 letter described the remedy as follows:

Ford will notify owners, and dealers will update the software for the power steering control module (PSCM) and the instrument cluster module, free of charge. If a vehicle shows a history of a loss of the torque sensor signal or fault codes relating to the PSCM when the vehicle is brought in for the recall remedy, the affected components will be replaced, free of charge. The recall is expected to begin by July 25, 2014.

On July 1, 2014 Ford sent instructions to its dealers providing information about how to complete the recall. This notice advised dealers that the software needed to perform the recall repair was still not available and would be released on July 9, 2014. The July 1 dealer notice described the repair procedure for the defect:

Dealers are to check the Power Steering Control Module (PSCM) for Diagnostic Trouble Codes (DTCs).

- If DTC B1342, B2277, or B2278 are NOT present, reprogram the PSCM and the Instrument Cluster (IC) module.
- If only DTC B2278 is present, replace the torque sensor.
- If DTC B1342 or B2277 is present, replace the steering column assembly.

The July 1, 2014 dealer notice further stated that the software update remedy option would not be available until July 9, and that until that date vehicles should only be repaired if a “vehicle arrives at your dealership with a customer complaint of loss of steering assist accompanied by one of the DTCs” identified in that bulletin (i.e. those requiring replacement of the torque sensor or steering column assembly). The “Dealer Q&A” portion of the bulletin also

⁶ Ford’s amended report should have indicated replacement of the steering column assembly rather than the PSCM. Steering column replacement is required to repair faults in the PSCM or motor, neither of which can be serviced separately. This error was corrected in subsequent dealer instructions sent by Ford on July 1, 2014.

directed dealers to inform owners of vehicles that received the software update that any post-remedy replacement of the torque sensor or steering column would not be covered by Ford's recall because "the modules were reprogrammed to prevent sudden loss of steering assist while driving."

In its May 15, 2015 information request letter (IR letter) to Ford, NHTSA requested information to assist in the evaluation of DP15-001.⁷ The IR letter asked Ford to explain why the remedy procedure for the recall provides for free replacement of the torque sensor or steering column for fault codes associated with the torque sensor, PSCM or EPAS motor or at the time the remedy is performed, but not after the remedy is performed. Ford's June 26, 2015 response to NHTSA's IR letter included the following explanation:⁸

The purpose of the remedy procedure is to mitigate the occurrence of the loss of power steering assist while driving due to the torque sensor, and to provide audible and visual warnings to the driver if a torque sensor fault is detected by updating the PSCM software. Additionally, if DTC's related to the PSCM (B2277 and B1342) or Torque Sensor (B2278) are present at the time of service, additional parts were replaced to better manage customer expectations.

Ford's strategy appears to have been effective in managing customer expectations when dealers performed the recall repairs on the subject vehicles, as there have been very few complaints related to that service. However, the strategy appears to have produced additional customer expectations regarding how Ford would manage post-remedy EPAS repairs to the torque sensor and other EPAS components covered by Ford as part of the recall repair procedure (i.e., PSCM or motor faults requiring steering column replacement). Most of the post-remedy

⁷ Jeffrey Quandt, letter to Todd Fronckowiak, May 15, 2015 (<https://static.nhtsa.gov/odi/inv/2015/INIM-DP15001-62000.pdf>)

⁸ Wayne Bahr, letter to Frank Borris, June 26, 2015 (<https://static.nhtsa.gov/odi/inv/2015/INRL-DP15001-62304P.pdf>)

complaints received by NHTSA through the end of 2017 include references to unhappiness with Ford's policy for handling repair costs associated with torque sensor repairs and a variety of other EPAS conditions after performing recall repairs.

2.3 NHTSA's analysis of safety hazards associated with loss of power steering

Prior investigations and recalls associated with defect conditions that may result in loss of power steering assist have established that such failures may result in an increased risk of crashes during low-speed vehicle maneuvers when they occur while driving and without warning. Testing conducted as part of several defect investigations by NHTSA's Vehicle Research and Test Center (VRTC) in East Liberty, Ohio, and others have found that the increases in driver hand-wheel efforts that result from loss of power steering assist are greater at parking lot speeds. The greatest efforts are required when the vehicle is stationary and the steering torque must overcome the static frictional forces from the tire contact patch with the road surface. Front-axle weight, tire size and tire inflation pressure are the primary factors affecting tire-road frictional forces when stopped and in low-speed parking and turning maneuvers.^{9,10} Additional increases in steering torque in low-speed maneuvers are primarily influenced by steering angle.¹¹ Changes in steering torque in higher speed maneuvers are primarily influenced by the lateral acceleration of the vehicle. Steering torque requirements decrease with increasing speed, as the safe and normal ranges of steering angles and lateral accelerations become smaller and smaller. At all speeds, while more difficult, drivers are able to maintain vehicle control after losing power

⁹ There are multiple other factors affecting steering torque, including rack friction, steering and suspension ball joint friction, and scrub radius. Additional factors affecting manual steering effort include steering ratio and steering wheel diameter. These effects are normally minor in comparison with front axle weight.

¹⁰ For purposes of this discussion, speeds less than 20 km/h (13 mph) are considered low speed.

¹¹ Sharp, R.S., Granger, R. (2003). *On Car Steering Torques at Parking Speeds*, Electrical and Electronic Engineering, Imperial College of Science, Technology and Medicine, Exhibition Road, London SW7 2BT.

steering assist because the mechanical linkage between the steering wheel and the road is maintained at all times.

There are very few published studies related to the effects of loss of power steering assist on vehicle directional control and crash risk. A study conducted by Transport Canada focused on the effects in low-speed turns, evaluating driver response to unexpected loss of assist in right-hand turns at a simulated traffic light at approximately 10 km/h (6 mph).¹² The study included vehicles ranging in size from compact passenger cars to a large sport utility vehicle and a mixed demographic group of drivers. The study found that, for each of the vehicles evaluated, at least 40 percent of drivers were not able to safely complete the turning maneuvers after an unexpected loss of steering assist.¹³ The same study found that, when aware of the loss of power steering assist, drivers were able to negotiate the course without any unsafe turns at the same speeds as recorded with full power steering assist. Similar results have been noted in human factors testing conducted by VRTC in support of NHTSA loss of power steering investigations.¹⁴

NHTSA considers the facts and evidence for each issue independently when deciding when to investigate allegations of loss of power steering assist. Based in part on vehicle testing and analysis of field data from prior investigations, NHTSA considers multiple factors, including: operating mode, warning, vehicle factors, system factors and failure rate.¹⁵

¹² Harbluk, J.L., Burns, P.C., Malone, D., Hamilton, J. (2014). *Power Steering Assist Failures: Driver Behavior, Safety Impacts, and Implications for Automated Vehicles*, Proceedings of the Human Factors and Ergonomics Society 58th Annual Meeting, 2073-2077.

¹³ The study classified turns as safe if the driver completed the maneuver without stopping or departing the intended lane of travel to any degree.

¹⁴ See document files for investigation ID's RQ10-004 and PE10-038 at www.nhtsa.gov (<https://www.nhtsa.gov/recalls>).

¹⁵ Vehicle factors include size/mass (i.e., steer axle weight) and steering design factors that influence the magnitude and proportion of the change in steering effort when transitioning to manual mode; system factors include the likelihood of the fault occurring in a critical operating state and the harshness of the steering feedback, if any, in the transient state.

Conditions that result in loss of assist at start-up or after prior visual, audible and/or tactile warning do not present a significant risk of crash or injury.

2.3.1 Ford EPAS: System design

In the Ford EPAS system, a column-mounted electric motor drives the steering gear to provide steering assist to the driver using battery power. The system senses the speed, direction, and amount of effort, or torque, applied to the steering wheel by means of a torque sensor located in the steering column assembly. The signal from the torque sensor is relayed to an electronic control unit (the PSCM). A PSCM control algorithm generates a signal to drive the motor to provide steering assistance in proportion to the driver's steering effort and vehicle speed. The system reduces the amount of assist supplied to the driver as vehicle speed increases to provide the desired road feel at the steering wheel.

The Ford EPAS system continuously performs diagnostics to identify faults that could potentially result in safety hazards (e.g., unintended steering torques) or damage to the system. The system responds to fault detection by transitioning to appropriate failsafe operating modes, including removing assist and transitioning to manual steering mode. Table 1 shows the primary fault conditions and failsafe modes associated with the subject EPAS system prior to the software update associated with the subject recall.

Fault Code	Fault Name	Failsafe Mode	Conditions to Restore EPAS
C195C	Low voltage (< 11V)	Reduced performance state following voltage capability of the vehicle	Voltage returns to value within specified tolerance within same ignition cycle
B1317	High voltage (> 16V)	Ramp out to zero assist	
B1318	High voltage (> 18V) or Low voltage (< 9 V)	Remove assist	
B1342	Micro test failure	Remove assist	Reevaluate at next ignition cycle if condition still exists
B2277	Motor failure	Remove assist	
B2278	Torque sensor failure	Remove assist	

Table 1. Fault Conditions and Failsafe Modes Related to Reduced or Removed Assist

for Subject Vehicles Before the Recall Software Update.

As shown in Table 1, prior to the remedy software update, the EPAS system responded to certain faults detected in the torque sensor, PSCM or motor by removing assist and transitioning to manual steering. The system remains in the failsafe mode until the conditions are met for clearing the fault and restoring normal EPAS. For faults detected in the torque sensor, PSCM, or motor, the vehicle remains in failsafe mode for the remainder of the ignition cycle in which the fault is detected—meaning that the vehicle must be turned off and restarted to clear the fault code and re-establish power steering. The system restores steering assist if the fault condition is no longer present on a subsequent ignition cycle.

Each of the fault codes associated with the subject EPAS system, including those shown in Table 1, are stored for 64 ignition cycles before the system clears them from memory.

2.3.2 Ford EPAS: Temporary reduced assist

In its June 26, 2015 response to NHTSA’s IR letter, Ford identified several factors that may result in temporary “reduced assist” in the subject EPAS system and which may be reported by some owners as a loss of power steering assist. For example, Ford provided the following description of how the system may temporarily reduce assist during periods of low battery voltage:

Some of the reports pertain to reduced assist resulting from low battery voltage, such as when the vehicle is exposed to low ambient conditions, and operated at near idle engine speed, and with heavy electrical load. When the electric power assist system detects low system voltage, it will reduce the amount of assist it provides. Reduced assist is a protective response from the EPAS system to prevent engine stalling due to the low system voltage. It is not a defect of the EPAS system but instead a symptom of a potentially failing battery or other electrical system concern. Service bulletin SSM 20895 and the workshop manual direct the

technician to inspect the vehicle electrical system for the root cause of the low system voltage. This condition of **reduced** assist could mistakenly be reported as a **loss** of assist.

In addition to low battery voltage, Ford indicated that the EPAS may also temporarily reduce assist when the steering is fully turned to one side or the other (i.e., the steering is turned near the physical rack stops) or during extreme usage conditions that result in PSCM overheating due to heavy sustained use by the driver. Reductions in steering assist that result from these factors are most likely to be experienced in low-speed parking maneuvers with significant steering inputs, such as parallel parking.

2.3.3 Ford EPAS: Torque sensor failures

The EPAS system at issue uses a contact-type torque sensor to measure driver steering input. Over time, the subject torque sensors may develop a poor signal-to-noise ratio (noisy signal) due to degradation of the sensor conductive surfaces. This may result in distortion, interruption or dropout of the signals, resulting in a Steering Shaft Torque Sensor Malfunction fault (DTC B2278). Early in MY 2011 production, Ford began using an improved torque sensor with lubricant added to the conductive surfaces to reduce long-term degradation. Vehicles built on or after September 11, 2010 were equipped with steering column assemblies containing the improved design and thus, were not included in the recall.

Ford's analysis found that the conductive surface degradation occurs at or near the on-center position where the steering wheel is held for the majority of road travel time and miles. This can result in noisy signals from the torque sensor, which may initially cause a perceptible steering wheel dither condition for some period prior to a loss of power steering.¹⁶ Complaints

¹⁶ "Dither" is a term used by Ford and other automotive companies to describe a low-amplitude oscillation of the steering wheel.

describe the dither condition as a shimmy, vibration, pulsing, or shaking of the steering wheel.

The condition is most evident when the vehicle is stopped and idling and the steering wheel is in a position that aligns with the degraded contact surfaces.¹⁷ Prior to being remedied, noisy signals from the torque sensor may result in detection of a Steering Shaft Torque Sensor Malfunction (DTC B2278) fault, which would immediately remove the power assist with no audible or visual warning provided to the driver. Ford provided the following description of the dither condition in its IR response letter:

Steering wheel dithering prior to a loss of assist has been noted in a number of reports, providing tactile feedback that the system is not functioning normally. As previously noted, the degradation of the conductive surface of the torque sensor may result in increased levels of signal noise to the PSCM. This increased signal noise may result in the steering wheel dither experienced by the driver. The amount of input supplied by the EPAS system to the steering column during this dithering is limited to approximately 2 Nm maximum and, while readily noticeable, can be easily managed by the driver. The updated PSCM software provided with the recall remedy is more tolerant of the signal noise. However, if the signal noise increases beyond this level, a diagnostic trouble code (DTC B2278) for the torque sensor will be stored in the system and a visual and audible warning will be given to the driver. Should the signal noise persist and/or increase, the PSCM may eventually remove power steering assist, but only at the beginning of the next key cycle (with the accompanying visual and audible warnings). The repair for this condition, as defined in the workshop manual, is torque sensor replacement.

Prior to February 2014, the torque sensor was not available as a separate replacement part and repairing failed torque sensors required replacement of the entire steering column assembly. This changed in February 2014 when Ford issued Technical Service Bulletin TSB 14-0016 and

¹⁷ Torque sensor signal dropouts generally occur near the center or zero-degree steering position.

began providing torque sensor kits as service parts for faulty torque sensors, thereby reducing the repair cost for torque sensor failure by over 50 percent.¹⁸

In May 2014, Ford submitted the DIR to NHTSA for the subject recall. As previously noted, the recall remedy involved updating the PSCM software to change the conditions under which the EPAS removes power assist following detection of torque sensor faults related to the noisy signal condition. Once the EPAS software update is completed, the system alerts the driver with an audible chime and warning lamp when EPAS detects the torque sensor fault; however, the system maintains full power steering assist through that ignition cycle and the fault does not result in a sudden loss of assist while driving. If the torque sensor fault persists or worsens, the system may remove power steering assist when the driver starts the vehicle at the beginning of the next ignition cycle. Owner notification for the recall started in July 2014.

2.3.4 Ford EPAS: Recall 14V-284 defect description

Ford's Part 573 letter for the subject recall described the defect condition as follows:

In some of the affected vehicles, a poor signal to noise ratio in the torque sensor within the Electric Power Steering (EPS) system does not allow the PSCM to determine the driver's steering input. Once this condition is detected, the system removes power steering assist, and defaults to manual steering mode. In the event of a loss of power steering assist, the mechanical linkage between the steering wheel and the road is maintained at all times. Loss of power steering assist while driving would require higher steering effort at lower vehicle speeds, which may result in an increased risk of a crash.

As defined by Ford and confirmed by NHTSA's examination of available data, the defect here consists of a torque sensor design that is prone to contaminant accumulation leading to

¹⁸ The torque sensor kit included a redesigned torque sensor service part (Part Number CL8Z-3F818-A) and instructions for replacing the torque sensor. The repair costs for replacing the torque sensor using the kit may range from \$500 to \$700, while costs for steering column replacement may range from \$1200 to \$1500 on average.

incomprehensible, noisy or intermittent signals being sent to the PSCM (which results in loss of power steering assist while the vehicle is being driven). Accordingly, Ford's defect report described the safety risk as a loss of power steering assist *while driving*. The defect identified does not include other torque sensor failure conditions, failures in other EPAS components such as the PSCM or PSM, EPAS faults at vehicle start-up (i.e., not while driving), and faults that are not associated with the EPAS system.

3.0 Analysis of the petition

Per the regulatory requirements, NHTSA's analysis of the petition includes the following factors: the nature of the complaint; the seriousness of the alleged breach of the vehicle manufacturer's obligation to remedy defects; the existence of similar complaints; NHTSA's ability to resolve the problem without holding a hearing; and other pertinent matters.

The nature of the Petitioner's complaint is that the remedy provided by "Ford has failed to adequately remedy" the safety defect. As evidence for this, the Petitioner points to her own experience with loss of power steering assist after receiving the remedy:

Soon thereafter, I started experiencing issues with my power steering (i.e. excessive shaking, loss of power steering). I took my vehicle back to the dealership in January 2015. According to the technician, my torque sensor failed and they needed to replace my entire steering column. **Specifically, the technician pulled fault code B2277 at this time.**

Pet. at 3 (emphasis in original).

The Petitioner's description of the post-remedy problem includes evidence of the torque sensor fault addressed by the subject recall (e.g., excessive shaking of the steering wheel and a technician's reference to a torque sensor failure). However, it also includes evidence indicating that a different or additional fault occurred. The Petitioner states, with emphasis, that "the technician pulled fault code B2277 at this time" and references B2277 four more times in the

petition. As shown in Table 1, B2277 is the fault code for a power steering motor failure. The recommended repair cited by the Petitioner, steering column replacement, also suggests that the failure in the Petitioner's vehicle may not have been related, or limited, to the defect underlying the recall, which is ordinarily repaired by torque sensor replacement.¹⁹

NHTSA identified 632 complaints alleging post-remedy EPAS system problems in the subject vehicles and received by the Agency from August 2014 through the end of 2017. In general, the complaints lack sufficient detail to determine the root cause, failure mode, or operating state for each of the reported incidents. The complaints include multiple fault conditions (e.g., torque sensor, PSCM, motor), failure modes (loss of power steering, temporary reduction of power steering assist, steering dither and EPAS warning message or wrench lamp illumination²⁰); and operating states (incidents occurring while driving, at start-up or during parking maneuvers). NHTSA's analysis of post-remedy EPAS complaints in the subject vehicle focused on two separate issues: 1) evidence of any other EPAS component defects that were not addressed by the recall remedy; and 2) the effectiveness of the software update in mitigating the risk of loss of power steering while driving from torque sensor faults.

3.1 Analysis: EPAS fault field experience by causal component

NHTSA's analysis of recall repair data, part sales, and owner complaints all indicate that the torque sensor continues to be the primary cause of EPAS system malfunctions in the subject vehicles after completion of the recall remedy. Through August 2017, Ford had completed the recall remedy in approximately 79 percent of affected vehicles, with approximately 2.8 percent of the repairs requiring replacement of the torque sensor or steering column due to faults

¹⁹ Steering column replacement is the repair required for power steering motor failure and other EPAS faults not related to the torque sensor (e.g., PSCM failure).

²⁰ Vehicles with the lowest level cluster option provide a wrench light instead of a warning message when the EPAS system detects a torque sensor fault after the PSCM has received the recall remedy update.

detected in the torque sensor, PSCM, or power steering motor at the time the recall remedy was performed. The torque sensor kit accounted for almost two-thirds (64%) of such repairs.

Similarly, analysis of part sales data determined that torque sensor kit sales make up 63 percent of EPAS part sales over the last 12 months.²¹ Although most of the complaints reviewed by ODI lacked sufficient detail to determine the causal component or driving state, the torque sensor was identified in approximately 73 percent of the complaints that did provide enough detail to identify the faulty component.²² The data do not identify a significant rate or trend for any other EPAS component or condition.

3.2 Analysis: Post-remedy torque sensor failures

NHTSA's analysis of complaints alleging post-remedy EPAS malfunctions diagnosed as torque sensor faults indicates that the faults are usually being detected before a loss of assist occurs (e.g., by a warning message or from symptoms related to dithering condition) and/or result in loss of assist at vehicle start-up, when the safety risk has been minimized. The Petitioner takes issue with Ford's characterization of these events as being "unlikely" and NHTSA agrees that the rate of torque sensor failures is higher than it would have been if the signal degradation issue identified by Ford did not exist. However, based on the information available to NHTSA, the likelihood of failure is low in comparison to other defect conditions related to loss of power steering assist that have been addressed by recalls by Ford and other manufacturers, as evidenced by analysis of total part sales through the end of 2017, when the subject vehicles range in age from 6 to 11 years in service. This analysis indicates fewer than 10 percent of all 2008 through 2011 Escape and Mariner vehicles have required a steering column

²¹ Since June 2014, approximately 27 percent of torque sensor kit sales and 22 percent of steering column sales have been associated with repairs performed under the subject recall.

²² One-hundred ninety-five (195) complaints identified the torque sensor (143), PSCM (46), or motor (6) as the component diagnosed by the servicing facility as the faulty part.

or torque sensor replacement that could be related to a torque sensor fault.²³ Furthermore, Ford's remedy removes the safety hazard, i.e. sudden loss of power steering assist while driving, resulting from such failures.

As noted in the petition, a key metric of remedy effectiveness is its effect on crash and injury trends related to EPAS issues in the subject vehicles.²⁴ NHTSA has reviewed all crash and injury allegations related to the EPAS system in the subject vehicles by recall remedy completion status (see Table 2). Through the end of 2017, NHTSA had received 22 complaints alleging crashes resulting from loss of power steering while driving, including 10 alleging injuries. Many of these incidents were very minor. For example, NHTSA was able to verify evidence of collision damage repairs for just 9 of the 22 vehicles identified in the crash allegations, including 8 of the 10 alleging injuries.

Crash Severity	Injury Allegations	14V284 Recall Remedy Status		
		Not Completed	Completed	Total
Evidence of collision repair	All crashes	8	1	9
	Injury crashes	8	0	8
	Injuries	8	0	8
No evidence of collision repair	All crashes	7	6	13
	Injury crashes	2	0	2
	Injuries	2	0	2
Total	All crashes	15	7	22
	Injury crashes	10	0	10

²³ NHTSA defect investigations that have influenced recalls related to loss of power steering while driving have identified specific fault conditions affecting a defined population of vehicles that have resulted in warranty claim rates well over 1% of vehicles sold after about 3 years-in-service (YIS) and 10 YIS failure rates estimated by statistical modeling that range from 16 to 68% of vehicles sold. See files for investigation ID numbers PE10-005, PE10-021, EA11-005, EA11-014, PE12-017 and PE14-030 at www.nhtsa.gov (<https://www.nhtsa.gov/recalls>).

²⁴ A petition footnote cites concerns that an ineffective remedy would result in continued incidents resulting in injuries, "As of August 20, 2013, Ford was aware of five accident allegations and six injury allegations potentially pertaining to this subject. More recent data on injuries potentially pertaining to this subject were not available, but Petitioner assumes this number has increased since that time, and will continue to increase until Ford actually repairs the recall on affected vehicles."

	Injuries	10	0	10
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Table 2. Crash Allegations Before and After Recall Remedy Completion.

None of the injury allegations and only one of the incidents severe enough to require collision repairs involved a vehicle that had been remedied under the recall and that crash was reported as a minor parking lot collision resulting in \$1,100 of front end damage. NHTSA's analysis of crash and injury allegations indicates that Ford's recall remedy appears to have been effective in mitigating the safety hazards associated with loss of power steering assist while driving in the subject vehicles.

3.3 Analysis: Summary

The Petitioner references the similar experience of others as identified in complaints to NHTSA and through various websites and online forums in support of the position that Ford's remedy was not adequate. The Petitioner's claim is serious and the frustration Petitioner experienced is understood by NHTSA. However, the defect identified by Ford was "[l]oss of power steering assist while driving" caused by a particular defect in the torque sensor and not, as Petitioner understands it, by any EPAS malfunction requiring replacement of the steering column or torque sensor, under any operating condition, regardless of cause. NHTSA's research and knowledge on this subject supports Ford's conclusion that the safety risk is limited to the loss of power steering assist while driving.

In contrast, a driver who does not have power steering assist when starting the vehicle will know that immediately, as it will be difficult to turn the steering wheel at low speeds, and will be prepared to compensate for it while driving (or may choose not to drive). Ford's software update remedy, as explained in Ford's DIRs, "changes the torque sensor fault strategy and will no longer remove power steering assist during an ignition cycle for a single torque sensor fault.

Additionally, the software update will provide audible and visual warnings to the driver in the unlikely event that a torque sensor fault is detected.”

Because Ford’s change in fault logic prevents the loss of power steering assist while the vehicle is in operation (if there is only one fault), the safety risk, i.e. the loss of power steering assist while driving, is addressed. Instead, the vehicle will turn off the power steering assist when the vehicle is turned off (or, as Ford puts it, after that “ignition cycle”). Thus, the safety risk of losing power steering assist while driving has been resolved. Further, the addition of visual and audio warnings to the driver in the event a torque sensor fault is detected alerts the driver to the need for service to the EPAS system prior to a loss of power steering assist and to the need for additional effort required to maneuver the vehicle if power steering assist is removed by the system before service repairs are performed. Thus, Ford’s software update remedy does address the safety risk identified, which is the loss of power steering assist while driving, and without warning.

This is not to say that the Petitioner may not have good reason to be displeased with the result. Approximately two months after receiving Ford’s recall repair, Petitioner’s vehicle suffered the problem that two months earlier would have entitled her to a remedy that instead would cost her approximately \$1,000 to obtain. This is certainly cause for frustration. However, NHTSA’s authority over vehicle manufacturers is limited to issues related to safety. In this instance, Ford’s software update remedy removed the safety risk of a driver losing power steering assist, without warning, while operating the vehicle.

Because the nature of the complaint does not allow NHTSA to grant the petition, we will only briefly address the other factors set out in the regulations. On those points the agency notes that while the alleged breach of the obligation to remedy is serious, there is no factual breach in

this instance and that NHTSA does not have any ability to resolve the problem because the problem is outside the agency's authority to enforce automotive safety. Further, the existence of similar complaints, both in online forums (as noted by the Petitioner) and in NHTSA's databases searched in reference to this petition, does not support granting this petition because, again, there is no factual breach. Additionally, given the circumstances here, a hearing is not necessary to evaluate the alleged problem. Therefore, NHTSA has decided a hearing should not be held.

4.0 Conclusion

The Petitioner alleges facts that understandably have caused frustration surrounding the repair and operation of her vehicle covered by NHTSA Recall No. 14V-284. However, the issues raised in the petition do not warrant a public hearing because the remedy Ford provided addresses the safety risk posed by loss of power steering assist. That safety risk arises from the unexpected change in steering effort the driver may experience while driving. Since Ford's remedy resolves the safety risk over which NHTSA has legal authority, NHTSA has decided not to hold a hearing on whether Ford has reasonably met the remedy requirements of the Safety Act.

For the reasons set forth above, NHTSA hereby denies Defect Petition DP15-001.

Authority: 49 U.S.C. § 30120(e); 49 CFR Part 557; delegations of authority at 49 CFR §§ 1.95 and 501.8.

Jeffrey M. Giuseppe,

Associate Administrator for Enforcement.

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